

CALIFORNIA DIVISION OF MINES AND GEOLOGY

SUPPLEMENT NO. 2 to FER-181 East Airfield fault, Mesquite Lake fault, and Western Segment of the Pinto Mountain fault, San Bernardino County, California

by
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January 8, 1988

INTRODUCTION

Traces of the Mesquite Lake and Pinto Mountain faults were recommended for zoning for special studies, based on fault evaluations detailed in Fault Evaluation Report FER-181 (Bryant, 1986). New data have been developed for western segments of the Pinto Mountain fault in the Yucca Valley North and Yucca Valley South quadrangles and for the Mesquite Lake fault in the northern Twentynine Palms quadrangle (Figure 1). In addition, new evidence of faulting east of the Airfield fault was provided by Weaver and Butelo (1987).

SUMMARY OF AVAILABLE DATA

East Airfield Fault

A north-trending linear tonal contrast was mapped by Weaver and Butelo (1987) east of the previously zoned Airfield fault of Fife (1978) and Wahler Associates (1984) (Figure 2). Trenches excavated across the tonal lineament (TIII) and across the northern projection of the lineament (TI & TII) exposed a broad zone of fracturing in Holocene alluvial and playa deposits (Figure 2). TI exposed minor faults with apparent vertical displacements up to 1 inch (down to the west). TIII exposed similar minor faults with down-to-the-west displacements of up to 2 inches. A large, 3 to 12 foot-wide fissure infilled with Holocene alluvium was reported in trench TIII. This fissure is similar to fissures reported along the Airfield fault by Fife (1978) and Wahler Associates (1984). Fife (1978) concluded that the north-trending Airfield fault was a left-lateral strike-slip fault associated with the Mesquite Lake fault. Weaver and Butelo (1987) concluded that fractures and minor faults along the East Airfield fault formed in response to either regional tectonic stress or seismic shaking (differential settlement at depth).

Mesquite Lake Fault

A site investigation by Pioneer Consultants (1986) excavated trenches across the Mesquite Lake fault in the Ocotillo Heights area (Figure 2). Trenches T₁ and T₃ exposed a significant fault zone that offsets late Pleistocene alluvium, but the overlying soil had been removed by prior grading. T₄ exposed alluvium that may be faulted (vertical caliche veins), but no shear planes were reported. The apparent minor faulting in T₄ lies west of the principal trace of the Mesquite Lake fault mapped by Wahler Associates (1984) (Figure 2 and Figure 2a to FER-181). The slight differences in location between faults mapped by Wahler Associates (1984) and Pioneer Consultants (1986) suggest that this segment of the Mesquite Lake fault is somewhat distributive.

Pinto Mountain Fault

Traces of the western end of the Pinto Mountain fault were mapped by Grimes in 1981 and were evaluated in FER-181. An unpublished thesis by Grimes was completed in 1987 and became available to DMG after the completion of FER-181. Mapping by Grimes (1987) is very similar to the mapping by Grimes (1981) that was evaluated in FER-181 (Figure 3 and Figure 2d to FER-181). The most significant differences in Grimes' maps are the western extension of fault PM-3a and the addition of fault PM-3b (Figure 3). Grimes (1987) stated that fault PM-3a offsets older alluvium against granitic bedrock and is delineated by a vague vegetation lineament in late Pleistocene alluvium in the vicinity of locality 1 (Figure 3). Grimes reported that bedrock exposures of PM-3a were characterized by fractures and shear zones, but evidence of significant faulting was not observed. Grimes (1987) reported older alluvium faulted against bedrock at locality 2 (Figure 3).

Fault PM-3b was mostly inferred by Grimes (1987), based on older alluvium juxtaposed against bedrock at locality 3 (Figure 3) (Grimes, 1981), an inferred linear contact between Holocene alluvium and playa deposits, and left-laterally deflected drainages at locality 4 (Figure 3). Grimes (1987, p. 60) stated that the deflected drainages in older alluvium could be due to grading of an old airfield.

INTERPRETATION OF AERIAL PHOTOGRAPHS

Aerial photographic interpretation by this writer of faults in the study area was accomplished using U.S. Department of Agriculture (AXL, 1952, scale 1:20,000), U.S. Geological Survey (GS-VCMJ, scale 1:39,000), and U.S. Bureau of Land Management (BLM CAHD-77, scale 1:30,000) air photos. Only the East Airfield fault was independently mapped by this writer during this study (Figure 2). Faults mapped by Grimes (1987) were photo-checked (Figure 3), but interpretation of recently active faults by this writer along this segment of the Pinto Mountain fault is depicted in Figure 3d of FER-181. The Mesquite Lake fault in the Ocotillo Heights area mapped by this writer is depicted in Figure 3a of FER-181. None of the faults identified in Figures 2 and 3 were field checked.

East Airfield Fault

The East Airfield fault is delineated by a moderately to moderately well-defined zone of linear tonal contrasts in Holocene alluvium and playa deposits (Figure 2). Traces of the East Airfield fault mapped by Weaver and Butelo (1987) were verified by this writer (Figure 2). However, the fault can be traced farther north than shown by Weaver and Butelo (1987) and one strand is probably delineated by a very subtle scarp in Holocene alluvium, which is consistent with a down-to-the-west component of vertical displacement.

Mesquite Lake Fault

The Mesquite Lake fault in the Ocotillo Heights area is only moderately defined by a linear tonal contrast in latest Pleistocene alluvium, but just north of the quadrangle boundary the fault is delineated by a right-laterally deflected drainage and a scarp in Quaternary alluvium (Figure 3a to FER-181; Figure 2 to FER-181 Supplement No. 1, Hart, 1987).

Pinto Mountain Fault

Most faults mapped by Grimes (1987) were depicted in Grimes (1981) and previously evaluated in FER-181 (see Figures 2d, 3d). Recent activity seems to be stepping left from the Pinto Mountain fault to the Morongo Valley fault in the Yucca Valley North and Yucca Valley South quadrangles, forming an extremely complex and distributive zone of faulting. The only recently active faulting identified in this step-over area is a moderately defined zone of normal faults along the north and west sides of a large closed depression (Bryant, 1986, Figure 3d).

Fault PM-3a mapped by Grimes (1987) was generally not verified as a recently active fault (Figure 3). The linear tonal contrast in late Pleistocene alluvium was not verified or is poorly defined (locality 1, Figure 3). Geomorphic evidence of recent left-lateral strike-slip displacement in bedrock, such as deflected drainages, offset ridges, sidehill benches, and shutter ridges, was not observed along fault PM-3a (Figure 3).

Fault PM-3b mapped by Grimes (1987) is poorly defined and was not verified by this writer (Figure 3b). There is no geomorphic evidence of recent left-lateral strike-slip faulting in bedrock at locality 3, although a weak tonal lineament was observed at that locality (Figure 3). However, there is no geomorphic evidence of faulting to the east. The left-laterally deflected drainages reported by Grimes (1987) coincide with what appears to be the boundary of the old airfield, based on interpretation of 1952 U.S.D.A. air photos (locality 4, Figure 3). The mapped linear contact between Qol and playa deposits is poorly defined, based on air photo interpretation, but cannot be ruled out as a fault.

CONCLUSIONS

East Airfield Fault

The East Airfield fault is moderately well-defined and displaces Holocene playa deposits (Weaver and Butelo, 1987). Minor down-to-the-west displacements (1 to 2 inches) along a linear north trend are consistent with minor conjugate faults associated with the northwest-trending right-lateral strike-slip Mesquite Lake fault.

Mesquite Lake Fault

Trenching by Pioneer Consultants (1986) exposed evidence of faulting in latest Pleistocene to Holocene alluvium in the Ocotillo Heights area (Figure 2). The side-investigation by Pioneer Consultants partly verified previous mapping by Wahler Associates (1984) and Bryant (1986), although minor differences exist. These minor differences and the relatively minor shearing in alluvium inferred in Pioneer Consultants' trench T₄ (which is located west of the fault trace mapped by Bryant [1986]), indicates that the Mesquite Lake fault in the Ocotillo Heights area is somewhat distributive. Pioneer Consultants' trench T₂ indicates a connection between the two fault segments previously mapped by Wahler Associates (1984) and Bryant (1986).

Pinto Mountain Fault

The Pinto Mountain fault zone in the Yucca Valley North and Yucca Valley South quadrangles is complex and is only locally well-defined (Bryant, 1986). Recent activity along the Pinto Mountain fault zone probably steps left to the Morongo Valley fault, resulting in extensional faulting that bounds the northern and western sides of the closed basin at locality 38 (Figure 3d to FER-181). Faults (PM-3a and PM-3b) mapped by Grimes (1987) are generally poorly defined and are not delineated by geomorphic evidence of latest Pleistocene to Holocene displacement (Figure 3). The lack of development of significant faulting in granitic bedrock reported by Grimes (1987) suggests that faults PM-3a and PM-3b are only minor faults within the complex junction between the Pinto Mountain and Morongo Valley faults. Although faults PM-3a and PM-3b are poorly defined, very minor Holocene displacement cannot be completely ruled out.

RECOMMENDATIONS

Recommendations for zoning faults for special studies are based on the criteria of "sufficiently active" and "well-defined" (Hart, 1985).

East Airfield Fault

Zone for special studies well-defined traces of the East Airfield fault shown on Figure 4, based on Weaver and Butelo (1987) and Bryant (this report). Principal references cited should be this FER Supplement.

Mesquite Lake Fault

Slightly modify previously zoned trace of the Mesquite Lake fault shown in Figure 4 based on this supplement. Special Studies Zones boundaries should not be affected.

Pinto Mountain Fault

Do not modify existing Special Studies Zones boundaries recommended in FER-181. Faults PM-3a and PM-3b mapped by Grimes (1987) are neither sufficiently active nor well-defined.

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January 8, 1988

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2/17/88*

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